



## PLASTICITÉ, MISE EN FORME

### PLASTICITY, FORMING

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| Lecturers : 4.0 | TC : 4.0 | PW : 8.0 | Autonomy : 0.0 | Study : 4.0 | Project : 0.0 | Language : FR

#### Objectives

The aim is to raise awareness of the link between materials forming processes and elastoplastic properties of metallic materials. The first part of the course focuses on the main processes for metal forming: plastic metal stretching, foundry, etc. The second part of the course introduces the classical elastoplastic model. The objective is to understand the limits of the elastic model and the main issues to address in order to introduce plastic behaviour. The model is established following the interpretation of simple homogeneous mechanical tests (tension and tension-torsion) and a phenomenological approach. Practical works allow, among other things, an understanding of the influence of the metal forming process on the elastoplastic properties.

**Keywords :** Plastic metal forming, foundry, Yield stress, Elastic strains, Plastic strains, Isotropic hardening, Kinematic hardening, Yield criterion, Normality rule.

#### Programme

2 courses to present the basic concepts + 2 exercises to practice these notions on elastoplastic structures + 3 practical works:

PW1 - Metal forming: sand casting, permanent mould, machining operation with cutting tool

PW2 - Behaviour identification: identification of the elastoplastic properties of the materials formed during PW1 (tension and torsion mechanical tests); Study of the influence of forming process on these mechanical properties.

PW3 - Structural design: finite element analyses of structures made of material identified during PW2.

#### Learning outcomes

- To know how to perform two foundry processes.
- To understand phenomenological plasticity.
- To know how to manage experiments to identify the elastoplastic behavior of materials.
- To know how to interpret results of an elastoplastic finite elements simulation.

#### Independent study

**Objectifs :** This activity is not concerned with framed autonomy activities outside personal work.

**M ethodes :** This activity is not concerned with framed autonomy activities outside personal work.

#### Core texts

R. Hill, *THE MATHEMATICAL THEORY OF PLASTICITY*, Oxford University Press, 1998

P. Suquet *RUPTURE ET PLASTICIT E*, Ecole Polytechnique, 2006

J.J. Marigo *PLASTICIT E ET RUPTURE*, Ecole Polytechnique, 2012

#### Assessment

Final mark = 100% know-how.

Know-how mark = 100% continuous assessment